

A data base of synthetic photometry in the GALEX ultraviolet bands for the stellar sources observed with the International Ultraviolet Explorer

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ABSTRACT

Context. The Galaxy Evolution Explorer (GALEX) has produced the largest photometric catalogue of ultraviolet (UV) sources. As such, it has defined the new standard bands for UV photometry: the near UV band (NUV) and the far UV band (FUV). However, due to brightness limits, the GALEX mission has avoided the Galactic plane which is crucial for astrophysical research and future space missions.

Aims. The International Ultraviolet Explorer (IUE) satellite obtained 63,755 spectra in the low dispersion mode ($\lambda/\delta\lambda \sim 300$) during its 18 years lifetime. We have derived the photometry in the GALEX bands for all the stellar sources in the IUE Archive to extend the GALEX data base with observations including the Galactic plane.

Methods. Good quality spectra have been selected for the IUE classes of stellar sources. The GALEX FUV and NUV magnitudes have been computed using the GALEX transmission curves, as well as the conversion equations between flux and magnitudes provided by the mission (galexgi.gsfc.nasa.gov).

Results. Consistency between GALEX and IUE synthetic photometries has been tested using White Dwarfs (WD) contained in both samples. The non-linear response performance of GALEX inferred from this data agrees with the results from GALEX calibration. The photometric data base is made available to the community through the services of the Centre de Données Stellaires at Strasbourg (CDS). The catalogue contains FUV magnitudes for 1,631 sources, ranging from FUV = 1.81 to FUV = 18.65 mag. In the NUV band, the catalogue includes observations for 1,005 stars ranging from NUV = 3.08 to NUV = 17.74 mag.

Conclusions. UV photometry for 1,493 not included in the GALEX AIS GR5 catalogue is provided; most of them are hot (O-A spectral type) stars. The sources in the catalogue are distributed over the full sky, including the Galactic plane.

Key words. astronomical data bases – catalogues – surveys – Ultraviolet: stars

1. Introduction

The catalogue of ultraviolet (UV) sources generated by the Galaxy Evolution Explorer (GALEX) mission constitutes the most extensive data base of UV photometry (Martin et al. 2005, hereafter Ma2005; Bianchi 2014, hereafter B2014). As such, the GALEX near (UV) or NUV band and far (UV) or FUV band have become standards for the description of the Spectral Energy Distribution (SED) of sources in broad band photometry. The NUV band ranges from 1771 Å to 2831 Å with effective wavelength 2315.7 Å and the FUV band ranges from 1344 Å to 1786 Å with effective wavelength 1538.6 Å (Morrissey et al. 2007; hereafter M2007).

The UV detectors used by the GALEX mission were sensitive MCP type detectors with a global count rate limit of 100,000 counts s⁻¹ (M2007). As a result, the GALEX survey avoided the Galactic plane (B2014). Moreover, the photometric data base does not extend to bright UV sources that are ideally suited for calibration purposes.

The International Ultraviolet Explorer (IUE) (Boggess et al. 1978; hereafter B1978) contains the largest data set of UV spectra. Most of them were obtained in photometric conditions: good guiding, large aperture (10x20 arcsec) and low dispersion ($\lambda/\delta\lambda \sim 300$). We have used this spectral data base to compute

the FUV and NUV synthetic magnitudes of all stellar sources observed with IUE under this configuration (31,982 spectra).

In this research note, we describe the methods followed to derive the FUV and NUV magnitudes from the IUE spectra and quantify the photometric accuracy of these results by comparing GALEX and IUE-based photometry for the white dwarfs (WDs) contained in both samples. We also describe the contents and characteristics of the data base submitted to the Centre de Données Stellaires at Strasbourg (CDS).

2. The IUE data base of stellar spectra

The IUE data base contains 63,755 spectra obtained through the large aperture (10x20 arcsec) in low dispersion mode, from those we have selected only the stellar sources¹. This amounts to a grand total of 31,982 stellar spectra².

The IUE low dispersion spectra were recorded with three cameras: long wavelength prime (LWP), long wavelength redun-

¹ <http://sdc.cab.inta-csic.es/ines/InForm.html#class>

² No included in this census are: IUE sky images misclassified among the stellar sources or individual objects belonging to the SMC, LMC, clusters and associations with identification no recognized by the Centre de Données Stellaires (CDS, Strasbourg).

dant (LWR) and short wavelength prime (SWP) (B1978). From the 31,982 stellar spectra, 16,467 are SWP observations, 10,349 LWP observations and 5,166 LWR observations. Good quality spectra (according to the criteria defined in Sect. 4) are available for 1889 stars in the SWP camera and 1157 stars in the LWP or LWR cameras.

3. The GALEX photometric bands in the IUE spectra

GALEX was a 50-cm primary space telescope with a Ritchey-Chrétien mounting feeding simultaneously two detectors sensitive to the near and far UV making use of a multilayer dichroic beamsplitter (Morrissey et al. 2005, Ma2005). The GALEX photometric bands are defined in the mission documentation (M2007) and can be downloaded from the *GALEX* official webpage³. The FUV and NUV bands cover the spectral ranges 1344–1786 Å and 1771–2831 Å respectively (M2007); the transmittance curves are shown in Figure 1. FUV and NUV AB magnitudes are determined by means of the conversion:

$$\text{FUV} = -2.5 \times \log \left(\frac{\text{Flux}_{\text{FUV}}}{1.40 \times 10^{-15} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ Å}^{-1}} \right) + 18.82 \quad (1)$$

$$\text{NUV} = -2.5 \times \log \left(\frac{\text{Flux}_{\text{NUV}}}{2.06 \times 10^{-16} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ Å}^{-1}} \right) + 20.08 \quad (2)$$

(M2007).

The IUE long (1850 – 3300 Å) and short (1150 – 1980 Å) wavelength ranges (B1978) do not match exactly the GALEX bands. While GALEX FUV is completely contained in the IUE SW range, GALEX NUV is split between the LW and SW cameras. For this reason, we need to join SWP and LW spectra in order to compute NUV magnitudes. Therefore NUV photometry can only be provided for non-variable sources.

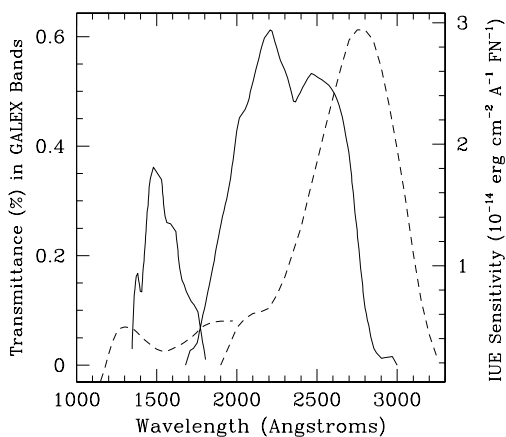


Fig. 1. GALEX transmission curves (solid) compared with IUE sensitivity curves (dashed) for the SWP and LWR cameras from Bohlin et al. 1980.

³ <http://galexgi.gsfc.nasa.gov/docs/galex/Documents/PostLaunchResponseCurveData.html>

4. Methods

4.1. Data Selection

Spectra have been retrieved from the IUE Newly Extracted Spectra (INES) Archive; data in this archive were processed using an optimised extraction algorithm that prevents the introduction of artifacts during the extraction while preserving the photometric accuracy (see Rodríguez-Pascual et al. 1999, for more details). The INES Archive is a final release from the European IUE Observatory.

The spectra are provided as FITS files binary tables that include four columns with: *Wavelength* (Å), *Flux* ($\text{erg cm}^{-2} \text{ s}^{-1} \text{ Å}^{-1}$), *Flux error* ($\text{erg cm}^{-2} \text{ s}^{-1} \text{ Å}^{-1}$) after pipeline processing⁴ and *Quality Flag* (QF), a quality measure for each pixel. *QF* = 0 indicates that the pixel flux is reliable, otherwise *QF* < 0. Negative QFs are given in powers of 2 (*QF* = -2^n with $n = 1 \dots 14$) and *n* is an identifier of the various possible sources of inaccuracies in the pixel photometry: microphonic noise, saturated pixel, reseaux mark, etc. (see <https://archive.stci.edu/ieue/manual/newsips/node20.html> for details).

The data base contains *all* data including overexposed, sub-exposed spectra as well as observations that suffered problems during the downlink, calibration, processing, etc. To avoid including bad spectra in the photometric data base, we removed from our list:

- spectra with more than a 10% of the pixels in the IUE spectrum flagged with *QF* < 0. The vast majority of the spectra contain reseau marks for the geometric calibration of the raw data and pixels flagged with *QF* < 0 close to the edge of the spectrum. For this reason we have worked with a tolerance of a 10%.
- spectra with average *Flux* smaller than three times the average *Flux error* in the corresponding GALEX wavelength range. Calibrated data include flux and flux error at each wavelength; this is the standard 3σ criterium applied to remove sub exposed spectra from the working list.

LW spectra require a more detailed examination since the peak transmittance of the GALEX NUV filter is at 2300 Å, in an area often sub-exposed in the spectrum of the cool stars observed with the IUE. To evaluate the SNR in this region, we define four windows in the 1975 Å – 2375 Å range: REG I (1975 – 2075 Å), REG II (2075 – 2175 Å), REG III (2175 – 2275 Å) and REG IV (2275 – 2375 Å). Within these windows we compute the mean flux and the dispersion. We reject the spectra if the mean flux is negative or if the standard deviation is ten times higher than the mean in any of the regions II–III–IV. We allow for a factor of ten to prevent removing sources with steep energy distributions or strong features.

4.2. Calculation of the FUV and NUV synthetic magnitudes

The integrated flux in the FUV band is computed from the SWP IUE spectra after multiplication by the normalised transmittance of the FUV filter. The flux of the flagged bad pixels (*QF* < 0) has been interpolated from good nearby pixels. The AB magnitude is calculated using a Eq. 1 (see Sect. 3).

To evaluate the NUV synthetic magnitude is necessary to determine firstly, whether the sources are variable (see Sect. 4.4 for a description of the procedure). In case there is not evidence of

⁴ (see Gonzalez-Riestra, Cassatella, Wamsteker 2001 for the absolute calibration of the INES IUE fluxes)

variability, the SW and LW are joined into a single spectrum; the matching wavelength is set at 1975 Å. After, the spectrum is multiplied by the normalised transmittance of the NUV filter. The flux of the flagged bad pixels ($QF < 0$) has been interpolated from good nearby pixels. The AB magnitude is calculated using a Eq. 2 (see Sect. .3).

In case there are multiple observations and the source is found not to vary, synthetic magnitudes are computed from the average flux.

4.3. Error determination

For each spectrum and band, the *Flux error* provided by the mission (column #3 in the data) is multiplied by the GALEX normalised transmittance to evaluate the total error in each band denoted as S_{FUV} and S_{NUV} for the FUV and NUV bands respectively. From that, magnitude errors are provided for the FUV band, $eFUV^+$ and $eFUV^-$, and NUV band, $eNUV^+$ and $eNUV^-$; note that the errors are asymmetric around the magnitude value because of the logarithmic scale.

In case there are multiple observations and the source is found not to vary, errors are from the *Flux errors*.

4.4. Multiple observations. Variable stars

There are 598 stars in the IUE archive with multiple observations in the SW range and 409 stars with multiple observations in the LW range. For those variability has been tested.

4.4.1. Stars with multiple observations in the IUE SW range

We compute for each SWP observation, i , the weighted flux in the GALEX FUV band, $F_{FUV}(i)$, calculated as:

$$F_{FUV}(i) = \int F_i(\lambda) G_{FUV}(\lambda) d\lambda \quad (3)$$

with G_{FUV} being the normalized GALEX FUV transmission curve (see Figure 1). The weighted *Flux error*, $S_{FUV}(i)$, is determined in the same manner:

$$S_{FUV}(i) = \int S_i(\lambda) G_{FUV}(\lambda) d\lambda \quad (4)$$

with $S_{FUV}(i)$ being the *Flux error* (see Figure 1).

After, the average, $\langle F_{FUV} \rangle$, the dispersion, $\sigma(F_{FUV})$, and the average *Flux error*, $\langle S_{FUV} \rangle$ are computed. We flag a star as variable if $\sigma(F_{FUV}) \geq 3 \times \langle S_{FUV} \rangle$. Note that very noisy data have already been rejected in the data selection process (see Sect. 4.1).

4.4.2. Stars with multiple observations in the IUE LW range

The procedure is similar to the described for the SW range but, in this case, the variability test is carried out only over the range of the NUV band contained in the LW images.

We compute for each LW observation, i , the weighted flux in the 1975 - 3000 Å range, $F_{GaLW}(i)$, calculated as:

$$F_{GaLW}(i) = \int_{1975}^{3000} F_i(\lambda) G_{NUV}(\lambda) d\lambda \quad (5)$$

with G_{NUV} being the normalized GALEX NUV transmission curve (see Figure 1), as well as the weighted *Flux error*, $S_{GaLW}(i)$,

$$S_{GaLW}(i) = \int_{1975}^{3000} S_i(\lambda) G_{NUV}(\lambda) d\lambda \quad (6)$$

After, the average, $\langle F_{GaLW} \rangle$, the dispersion, $\sigma(F_{GaLW})$, and the average *Flux error*, $\langle S_{GaLW} \rangle$ are computed. We flag a star as variable if $\sigma(F_{GaLW}) \geq 3 \times \langle S_{GaLW} \rangle$.

4.4.3. In summary

According to these criteria 52 stars are found to be variable in the LW range and 89 in the SW range; only 36 stars are found to be variable in both ranges. Therefore, $\sim 13\%$ of the stars with multiple observations in the LW range are found to be variable and $\sim 15\%$ of the stars with multiple observations in the SW range are found to be variable.

5. Photometric accuracy

The IUE sample (of non variable stars) provides good synthetic photometry for 103 WDs. 43 of these 103 WDs have a counterpart in the GALEX GR5 AIS survey (Bianchi et al. 2011) within a search radius of 3". We have used this subset to check the photometric accuracy of the synthetic magnitudes computed in this work (see Table 1 for their synthetic and GALEX magnitudes). The limiting magnitude of GALEX AIS⁵ (NUV ~ 20.5 mag) is high above the sensitivity threshold of IUE in low dispersion mode, therefore counterparts are identified for all sources within the area mapped by GALEX. Note that in May 2009, the FUV detector in GALEX stopped working and as a result, releases later to GR5 (such as GR6/7) only add new sources in the NUV band⁶ (B2014).

As shown in Figure 2, GALEX and IUE based UV photometries compare well except for the *brightest* sources; GALEX photometry is affected by photon count loses at high count rates. Following Camarota & Holberg (2014, hereafter CH), we have fitted the samples to a quadratic function using the least-squares method:

$$M_{GAL} = c_0 + c_1 M_{IUE} + c_2 M_{IUE}^2 \quad (7)$$

with M_{GAL} the WD magnitude as per the GALEX AIS catalogue and M_{IUE} , the IUE-based synthetic magnitude derived in this work. The coefficients of the fit, c_0 , c_1 and c_2 , are given in Table 3. We have found a very good agreement with CH's fits in the FUV photometry and a significant discrepancy in the NUV band that we ascribe to a possible typographic error in the parameters in CH's Table 2. The FUV, NUV synthetic photometry for the rest of the WDs in the IUE sample is provided in Table 4.

Table 2. Quadratic fit parameters for the WDs sample

Property	FUV	FUV
c_0	31.2738	24.9204
c_1	-3.4197	-2.3688
c_2	0.1552	0.1136
χ^2/dof	0.0064	0.0058
No. of stars	34	24
Lower bound	10.8	10.8
Upper bound	15.5	15.7

⁵ https://archive.stsci.edu/prepds/gcat/gcat_gasc_gmsc.html

⁶ In fact, late GALEX releases also add very weak FUV sources identified by being the counterpart of a NUV source. These sources are too weak to have been observed with IUE.

Table 1. Synthetic photometry in the GALEX bands of WD observed with IUE: WDs with GALEX counterpart

ID IUE	RAS (ICRS)	DEC (ICRS)	IUE based synthetic photometry				GALEX photometry					
			FUV	+eFUV	-eFUV	NUV	+eFUV	-eFUV	FUV	eFUV	NUV	eNUV
WD 0005+511	00:08:18.17	+51:23:16.6	11.09	0.06	-0.06	NA	NA	NA	12.190	0.004	13.178	0.004
EQ 0027+259	00:29:37.96	+26:10:28.47	13.60	0.07	-0.06	13.22	0.30	-0.24	13.567	0.008	13.785	0.006
WD 0039+04	00:42:6.12	+05:09:23.36	12.01	0.08	-0.07	NA	NA	NA	NA	NA	13.189	0.004
WD 0050-332	00:53:17.44	-32:59:56.6	11.47	0.07	-0.07	12.13	0.11	-0.10	NA	NA	12.365	0.003
WD 0112+104	01:14:37.8	+10:41:6	14.40	0.15	-0.13	14.66	0.28	-0.22	14.425	0.010	14.623	0.007
WD 0134+833	01:41:28.74	+83:34:58.9	12.34	0.07	-0.06	12.70	0.10	-0.09	12.923	0.002	12.938	0.002
WD 0232+035	02:35:7.59	+03:43:56.8	10.39	0.07	-0.06	11.01	0.11	-0.10	NA	NA	12.371	0.003
WD 0302+027	03:04:37.34	+02:56:57.9	13.31	0.11	-0.10	13.69	0.13	-0.11	13.008	0.007	13.968	0.007
WD 0320-539	03:22:14.83	-53:45:16.5	13.13	0.09	-0.08	NA	NA	NA	13.325	0.004	13.747	0.003
WD 0342+026	03:45:34.58	+02:47:52.81	10.44	0.07	-0.07	10.76	0.12	-0.11	NA	NA	12.751	0.003
WD 0453-296	04:55:35.94	-29:28:59.96	15.01	0.21	-0.17	15.03	0.23	-0.19	15.029	0.015	14.995	0.010
HS 0713+3958	07:17:2.7	+39:53:25	14.57	0.11	-0.10	15.05	0.23	-0.19	14.643	0.012	14.977	0.009
WD 0846+249	08:49:5.88	+24:45:7.93	14.45	0.08	-0.08	NA	NA	NA	14.436	0.013	15.147	0.011
WD 0853+163	08:56:18.96	+16:11:3.8	15.28	0.14	-0.13	15.31	0.50	-0.34	15.273	0.022	15.201	0.013
WD 0945+246	09:48:46.65	+24:21:26	14.38	0.08	-0.08	13.89	0.21	-0.18	14.479	0.011	13.955	0.005
PG 0958-073	10:00:47.25	-07:33:31.01	12.44	0.07	-0.06	12.90	0.13	-0.11	12.517	0.006	13.190	0.005
WD 1034+001	10:37:3.81	-00:08:19.31	10.85	0.06	-0.06	11.62	0.09	-0.09	NA	NA	12.865	0.002
WD 1114+072	11:16:49.35	+06:59:33	11.85	0.07	-0.06	12.24	0.13	-0.11	12.360	0.003	13.119	0.004
WD 1144+005	11:46:35.17	+00:12:33.6	13.69	0.09	-0.09	NA	NA	NA	12.921	0.008	13.691	0.006
WD 1211+332	12:13:56.25	+32:56:31.4	12.64	0.07	-0.06	13.22	0.11	-0.10	12.718	0.008	13.396	0.004
WD 1230+052	12:33:12.57	+04:57:37.7	12.04	0.07	-0.06	12.34	0.10	-0.09	12.544	0.004	13.732	0.004
WD 1233+427	12:35:51.14	+42:22:39.72	10.82	0.06	-0.06	11.13	0.12	-0.11	12.710	0.007	12.831	0.004
WD 1302+283	13:04:48.63	+28:07:29.3	13.69	0.11	-0.10	14.10	0.24	-0.19	13.802	0.009	14.238	0.005
WD 1326-037	13:29:16.39	-03:58:51.75	15.22	0.12	-0.11	15.20	0.33	-0.26	15.295	0.015	15.204	0.009
WD 1406+590	14:08:32.23	+59:40:25.1	11.93	0.11	-0.10	12.28	0.21	-0.18	12.690	0.003	12.548	0.002
WD 1445+152	14:48:14.38	+15:04:49.93	15.62	0.29	-0.23	15.57	0.38	-0.28	15.462	0.027	15.421	0.016
WD 1636+351	16:38:26.32	+35:00:11.9	13.09	0.09	-0.09	13.75	0.37	-0.28	13.236	0.005	13.854	0.003
PG 1637+346	16:39:36.02	+34:32:30.36	15.01	0.18	-0.16	NA	NA	NA	14.403	0.008	14.656	0.005
HS 1650+7229	16:49:16.1	+72:24:12	15.44	0.12	-0.11	NA	NA	NA	15.581	0.032	16.050	0.013
WD 1708+602	17:09:15.9	+60:10:11	11.82	0.04	-0.04	NA	NA	NA	12.707	0.005	12.565	0.003
WD 2034-532	20:38:16.84	-53:04:25.4	14.56	0.12	-0.11	NA	NA	NA	14.533	0.014	14.190	0.007
WD 2059+013	21:02:19.3	+01:32:15.9	13.93	0.09	-0.08	14.21	0.23	-0.19	13.982	0.007	14.364	0.005
WD 2110+127	21:13:21.06	+12:57:9.4	12.41	0.12	-0.11	NA	NA	NA	12.787	0.006	13.182	0.005
BPS CS 22951-0067	21:49:38.91	-43:06:14.28	14.70	0.08	-0.08	16.35	0.53	-0.36	13.511	0.010	14.312	0.004
WD 2149+021	21:52:25.38	+02:23:19.54	12.24	0.06	-0.06	12.51	0.12	-0.11	12.604	0.007	12.688	0.005
WD 2207-303	22:10:29.22	-30:05:43.7	12.63	0.06	-0.06	NA	NA	NA	12.596	0.004	13.539	0.003
HS 2237+8154	22:37:15.57	+82:10:27.32	17.45	1.40	-0.59	NA	NA	NA	17.396	0.040	16.923	0.021
WD 2246+223	22:49:5.76	+22:36:32.31	17.57	1.27	-0.57	NA	NA	NA	17.736	0.038	15.109	0.006
WD 2316+123	23:18:45.1	+12:36:2.9	16.70	0.56	-0.37	15.74	0.26	-0.21	16.889	0.045	15.783	0.011
WD 2331-475	23:34:2.2	-47:14:26.5	12.17	0.08	-0.07	NA	NA	NA	12.419	0.004	13.405	0.003
WD 2333-002	23:35:41.47	+00:02:19	14.22	0.12	-0.11	NA	NA	NA	14.149	0.014	14.719	0.010
WD 2342+806	23:45:2.26	+80:56:59.7	12.49	0.07	-0.07	13.27	0.11	-0.10	12.954	0.005	13.520	0.004
WD 2353+026	23:56:27.72	+02:57:5.61	13.85	0.11	-0.10	14.58	0.24	-0.20	13.829	0.007	14.357	0.006

Notes. NA means no available data.

6. The catalogue

The catalogue contains FUV magnitudes for all stars (with and without multiple observations) and NUV magnitudes only for non variable stars, or stars with just one good observation, as pointed out in Sect. 4.2. The number of observations used for the variability evaluation are indicated for all catalogue entries; ~ 65% of the sources have only one good observation.

Appendix A contains an excerpt of the on-line catalogue. For each source, the following entries are provided:

- Object identification in the IUE Archive.
- Right Ascension and Declination (ICRS).
- No. of SWP observations used to compute FUV.
- Synthetic FUV magnitude (Eq. 4) computed from the mean flux, if several observations are used (see section 4.2).
- Error in the synthetic FUV magnitude computed from the mean flux and error (see section 4.3).
- No. of LW observations used to compute NUV.
- Synthetic NUV magnitude (obtained from SWP and LW mean fluxes).
- Error in the synthetic NUV magnitude (obtained from SWP and LW mean fluxes).

For the 89 stars found to be variable in the SW range, additional entries are provided with the FUV synthetic magnitude for each observation (see Sect. 4.4); the following entries are provided:

- Object identification in the IUE Archive.
- Right Ascension and Declination (ICRS).
- Observation date and time.
- Synthetic FUV magnitude computed from the flux.
- Error in the synthetic FUV magnitude computed from the flux and error.

(see an excerpt in Appendix B).

The catalogue contains synthetic FUV magnitudes for 1,631 sources, ranging from FUV = 1.81 to FUV = 18.65. In the NUV band, the catalogue includes observations for 1,005 stars ranging from NUV = 3.08 to NUV = 17.74 mag. The distribution of sources in the sky is plotted in Figure 3; notice the good coverage of the Galactic plane. A summary statistics of the catalogue contents is available in Table 4. This work adds UV photometry for 1,493 new sources, most of them hot (O-A spectral type) stars. The catalogue is available to the community through the services of the Centre de Données Stellaires.

7. Conclusions

From an initial sample of 31,982 stellar IUE spectra, we have computed the synthetic photometry for:

- 1,631 sources in the GALEX FUV band with magnitudes ranging from FUV = 1.81 to FUV = 18.65.

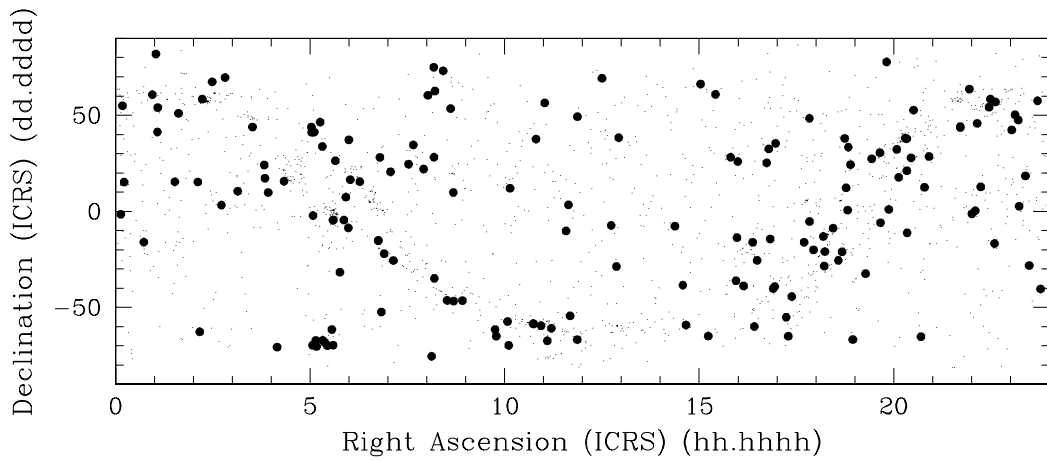


Fig. 3. Distribution in the sky of the sources in the catalogue. Variable sources (as per the criteria in Sect. 4.4) are indicated with filled circles.

- 1,005 sources in the GALEX NUV band with NUV ranging from NUV = 3.08 to NUV= 17.74 mag.

The FUV and NUV synthetic photometry compares well with GALEX. A sample of WD's observed with IUE and GALEX has been used for the test; a good agreement with CH has been found for the FUV band but no for the NUV band.

The catalogue is available to the community through the services of the Centre de Données Stellaires. It adds UV photometry for 1,493 new sources with respect to the GALEX AIS catalogue, most of them hot (O-A spectral type) stars. The sources in the catalogue are distributed over the full sky, including the Galactic plane.

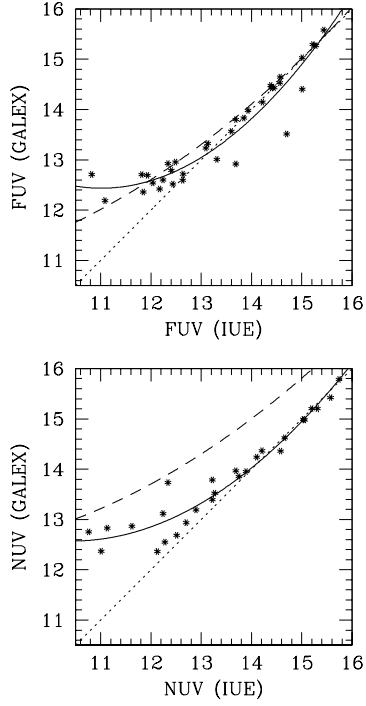


Fig. 2. IUE versus GALEX photometry for the WDs sample. The dotted line represents the 1:1 correspondence, the solid line the fit in Table 2 and the dashed line CH's fit.

Table 4. Catalogue contents

ID	IUE Class Description	Number of Stars		No. of IUE spectra used	
		All	in GALEX ^(a)	SW	LW
10	WC	22	0	70	57
11	WN	38	0	165	49
12	Main Sequence O	106	1	150	120
13	Supergiant O	38	0	58	27
14	Oe	4	0	6	2
15	Of	10	0	19	5
16	SD O	68	29	176	457
17	WD O	15	5	20	62
20	B0-B2 V-IV	143	5	294	294
21	B3-B5 V-IV	68	1	87	110
22	B6-B9.5 V-IV	139	7	218	139
23	B0-B2 III-I	111	2	169	64
24	B3-B5 III-I	25	1	48	24
25	B6-B9.5 III-I	57	3	85	43
26	Be	29	1	68	93
27	Bp	36	2	63	57
28	sd B	36	15	39	27
29	WDB	13	7	46	32
30	A0-A3 V-IV	111	5	150	117
31	A4-A9 V-IV	28	2	32	21
32	A0-A3 III-I	25	2	31	17
33	A4-A9 III-I	17	2	20	8
34	Ae	4	1	55	4
35	Am	13	1	16	12
36	Ap	20	1	70	87
37	WDA	73	26	101	102
38	Horizontal Branch Stars	26	6	33	18
40	F0-F2	39	3	41	51
41	F3-F9	52	8	60	47
42	Fp	1	1	1	1
44	G IV-V	74	20	210	106
45	G III-I	40	7	66	37
46	K V-IV	50	14	323	112
47	K III-I	35	8	61	16
48	M V-IV	22	2	106	52
49	M III-I	15	5	35	16
50	R, N or S Types	7	4	9	6
51	Long Period Variable Stars	1	0	1	3
52	Irregular Variables	10	0	18	15
53	Regular Variables	30	10	24	104
54	Dwarf Novae	33	17	62	61
55	Classical Novae	21	3	39	51
58	T Tauri	20	5	30	96

(a) Identified by cross correlation with the GALEX AIS GR5 catalogue. A search radius of 3 arcsec is used.

Table 3. Synthetic photometry in the GALEX bands of WD observed with IUE: WDs without GALEX counterpart

ID IUE	RAS (ICRS)	DEC (ICRS)	IUE based synthetic photometry					
			FUV	+eFUV	-eFUV	NUV	+eNUV	-eNUV
WD 2357+296	00:00:7.25	+29:57:0.31	13.06	0.11	-0.10	NA	NA	NA
WD 0017+136	00:20:1.79	+13:52:48.1	15.27	0.12	-0.10	15.09	0.17	-0.14
WD 0101+039	01:04:21.68	+04:13:37.06	10.89	0.11	-0.10	11.23	0.12	-0.10
WD 0104+50	01:07:11.02	+51:10:22.74	11.85	0.06	-0.06	NA	NA	NA
WD 0128-387	01:30:28.03	-38:30:38.7	15.84	0.26	-0.21	15.37	0.16	-0.14
WD 0131-164	01:34:24.07	-16:07:8.38	11.98	0.06	-0.06	12.83	0.11	-0.10
WD 0135-052	01:37:59.34	-04:59:44.3	NA	NA	NA	15.15	0.26	-0.21
WD 0141-675	01:43:1.04	-67:18:29.37	NA	NA	NA	17.13	3.06	-0.72
WD 0148+467	01:52:2.96	+47:00:6.65	12.60	0.06	-0.05	12.67	0.14	-0.12
WD 0214+568	02:17:33.52	+57:06:47.5	12.49	0.07	-0.06	NA	NA	NA
PG 0216+032	02:19:19	+03:26:54	12.45	0.06	-0.05	13.18	0.13	-0.11
WD 0227+050	02:30:16.62	+05:15:50.68	12.10	0.06	-0.05	12.43	0.10	-0.09
WD 0229-481	02:30:53.3	-47:55:26.2	12.41	0.06	-0.06	NA	NA	NA
WD 0232+525	02:36:19.54	+52:44:12.5	13.33	0.07	-0.06	NA	NA	NA
KUV 02503-0238	02:52:51	-02:25:17.99	14.63	0.12	-0.11	14.76	0.52	-0.35
WD 0255-705	02:56:17.21	-70:22:10.86	NA	NA	NA	14.84	1.08	-0.53
WD 0346-011	03:48:50.19	-00:58:32.02	12.02	0.11	-0.10	12.73	0.09	-0.08
KUV 685-13	04:50:13.52	+17:42:6.21	12.07	0.09	-0.08	12.59	0.16	-0.14
WD 0455-282	04:57:13.9	-28:07:54	11.76	0.07	-0.06	12.41	0.17	-0.15
WD 0509-007	05:12:6.39	-00:42:6	12.01	0.06	-0.06	NA	NA	NA
WD 0531-022	05:34:18	-02:15:0	14.28	0.43	-0.31	NA	NA	NA
WD 0612+177	06:15:18.69	+17:43:41	11.93	0.07	-0.07	12.48	0.17	-0.15
WD 0640+015	06:43:16.02	+01:30:12.6	13.81	0.08	-0.08	NA	NA	NA
WD 0651-020	06:54:13	-02:09:12	12.94	0.07	-0.06	13.59	0.21	-0.17
WD 0715-703	07:15:16.59	-70:25:5.6	12.08	0.07	-0.06	NA	NA	NA
WD 0836+237	08:39:33.3	+23:34:9	14.43	0.45	-0.32	NA	NA	NA
BD+48 1777	09:30:46.78	+48:16:23.77	8.87	0.05	-0.05	9.29	0.12	-0.11
PG 0934+553	09:38:20.35	+55:05:50.08	10.47	0.07	-0.07	NA	NA	NA
WD 1013-050	10:16:28.68	-05:20:32.06	12.07	0.06	-0.06	12.71	0.11	-0.10
WD 1042-690	10:44:10.23	-69:18:18.03	11.88	0.05	-0.05	12.29	0.10	-0.09
WD 1105-048	11:07:59.95	-05:09:25.89	12.90	0.06	-0.05	13.08	0.10	-0.10
WD 1123+189	11:26:19.06	+18:39:17.85	12.08	0.06	-0.05	12.73	0.10	-0.09
WD 1234+482	12:36:45.18	+47:55:22.34	12.30	0.09	-0.08	12.94	0.11	-0.10
WD 1302+597	13:04:32.19	+59:27:32.78	13.33	0.07	-0.07	13.66	0.16	-0.14
WD 1321+36	13:23:35.26	+36:07:59.51	10.11	0.05	-0.05	10.40	0.10	-0.09
BD-07 3632	13:30:13.64	-08:34:29.5	12.33	0.10	-0.09	12.40	0.18	-0.15
WD 1337+705	13:38:50.48	+70:17:7.66	11.84	0.06	-0.05	12.23	0.12	-0.11
WD 1403-077	14:06:4.83	-07:58:31.21	13.66	0.08	-0.08	NA	NA	NA
WD 1424+534	14:25:55.46	+53:15:25.14	13.50	0.07	-0.07	14.23	0.21	-0.18
CD-37 10500B	15:47:30.07	-37:55:8.11	16.76	1.73	-0.64	13.97	0.20	-0.17
WD 1615-154	16:17:55.26	-15:35:51.93	11.65	0.08	-0.08	12.28	0.11	-0.10
CD-38 10980	16:23:33.84	-39:13:46.16	9.62	0.06	-0.06	10.15	0.10	-0.09
WD 1639+537	16:40:57.16	+53:41:9.6	NA	NA	NA	17.09	0.86	-0.48
WD 1657+343	16:58:51.12	+34:18:53.29	14.37	0.10	-0.09	NA	NA	NA
WD 1713+695	17:13:6.12	+69:31:25.7	13.07	0.15	-0.13	13.13	0.51	-0.34
WD 1725+586	17:26:43.36	+58:37:32.06	13.41	0.25	-0.20	NA	NA	NA
WD 1900+706	19:00:10.25	+70:39:51.2	13.88	0.15	-0.13	NA	NA	NA
** LDS 678A	19:20:34.92	-07:40:0.07	14.83	0.23	-0.19	NA	NA	NA
WD 1936+327	19:38:28.21	+32:53:19.9	12.54	0.08	-0.08	NA	NA	NA
LS II +18 9	19:43:31.21	+18:24:34.58	10.20	0.07	-0.06	10.77	0.10	-0.09
WD 2007-303	20:10:56.85	-30:13:6.64	12.13	0.06	-0.06	12.28	0.11	-0.10
RX J2013.1+4002	20:13:9.37	+40:02:24.25	12.10	0.06	-0.06	NA	NA	NA
WD 2028+390	20:29:56.16	+39:13:32	12.02	0.06	-0.06	12.56	0.17	-0.14
WD 2123-82	21:31:5.18	-82:40:53.25	12.46	0.07	-0.06	12.35	0.20	-0.17
WD 2211-495	22:14:11.91	-49:19:27.26	9.40	0.05	-0.05	10.23	0.10	-0.09
WD 2313-021	23:16:12.42	-01:50:35.06	11.79	0.07	-0.06	12.09	0.10	-0.09
GD 1110	23:19:24.43	-08:52:37.91	11.87	0.06	-0.05	NA	NA	NA
WD 2317-054	23:19:58.4	-05:09:56.16	10.07	0.05	-0.05	10.47	0.10	-0.09
GD 1309	23:29:12	-10:05:0	11.68	0.07	-0.06	12.09	0.11	-0.10
WD 2349+286	23:51:56	+28:55:12	14.39	0.22	-0.18	NA	NA	NA

Notes. NA means no available data.

Appendix A: Catalogue excerpt

An excerpt (first 10 entries) of the on-line catalogue is shown in Table A.1 (see Sect. 6, for a detailed description of the fields).

Appendix B: FUV magnitude - Variable stars

An excerpt (first 3 entries) of the list of FUV magnitudes for variable stars is shown in Table B.1 (see Sect. 6 for a description of the fields).

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Object	RA(2000) (hh:mm:ss.ss)	Dec(2000) (±dd:mm:ss.ss)	NobsSWP	FUV (ABmag)	+eFUV (ABmag)	-eFUV (ABmag)	NobsLW	NUV (ABmag)	+eNUV (ABmag)	-eNUV (ABmag)
CD-40 15307	00:00:20.14	-39:23:55.24	1	10.14	0.05	-0.05	1	10.16	0.11	-0.10
WD 2357+296	00:00:7.25	+29:57:0.31	2	13.06	0.11	-0.10	0	NA	NA	NA
HD 225094	00:03:25.71	+63:38:25.88	3	8.81	0.04	-0.04	1	8.64	0.08	-0.07
HD 225132	00:03:44.39	-17:20:9.57	6	6.42	0.04	-0.04	1	6.08	0.05	-0.04
HD 108	00:06:3.39	+63:40:46.76	1	8.36	0.05	-0.05	0	NA	NA	NA
HD 186	00:06:47.96	+44:36:46.2	1	9.07	0.05	-0.05	1	9.21	0.11	-0.10
BD+59 2829	00:06:48.3	+60:36:0.83	1	11.85	0.05	-0.05	0	NA	NA	NA
PG 0004+133	00:07:33.78	+13:35:57.66	1	13.04	0.09	-0.08	1	13.28	0.17	-0.15
WD 0005+511	00:08:18.17	+51:23:16.6	1	11.09	0.06	-0.06	0	NA	NA	NA
HD 358	00:08:23.26	+29:05:25.55	1	3.19	0.05	-0.05	0	NA	NA	NA

Table A.1. Catalogue layout (10 first entries).

Object	RA(ICRS)	Dec(ICRS)	Obsdate	Obstime	FUV	+eFUV	-eFUV
HD 352	00:08:12.1	-02:26:51.76	1985-08-02	10:10:00	15.02	0.19	-0.16
HD 352	00:08:12.1	-02:26:51.76	1981-05-20	02:02:03	14.34	0.08	-0.08
HD 352	00:08:12.1	-02:26:51.76	1984-06-14	02:06:56	15.19	0.15	-0.13
HD 5394	00:56:42.53	+60:43:0.27	1982-01-28	00:37:38	6.57	0.53	-0.35
HD 5394	00:56:42.53	+60:43:0.27	1988-07-10	13:18:22	1.90	0.03	-0.03
HD 5394	00:56:42.53	+60:43:0.27	1988-07-10	14:46:38	1.84	0.03	-0.03
HD 5679	01:02:18.45	+81:52:32.08	1978-05-15	17:07:54	9.46	0.06	-0.05
HD 5679	01:02:18.45	+81:52:32.08	1981-08-04	08:17:42	15.11	0.68	-0.41

Table B.1. FUV magnitude for variable stars layout (10 first entries).